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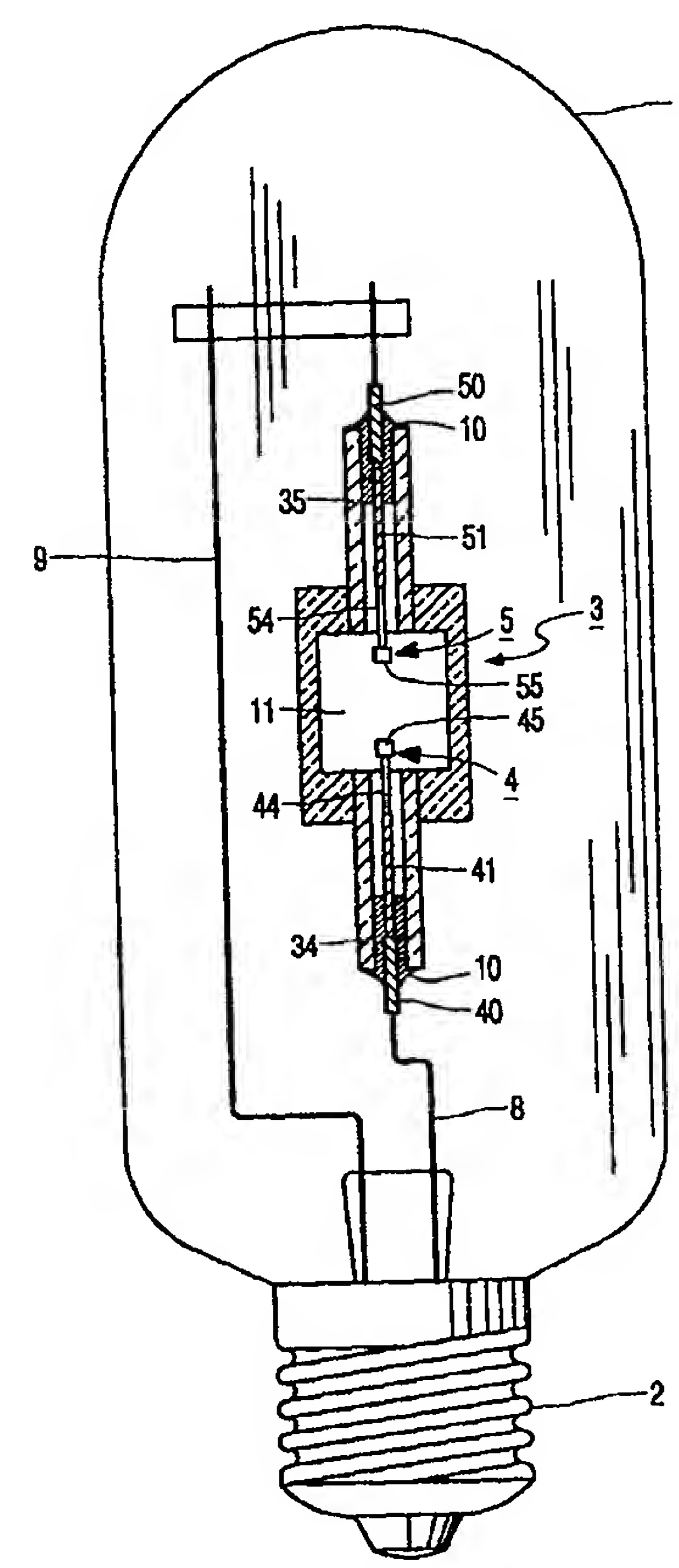
(54) Title: METAL–HALIDE LAMP

(57) Abstract

The invention relates to a metal–halide lamp comprising a discharge vessel with a ceramic wall, the discharge vessel enclosing a discharge space which contains an ionizable filling which filling contains a quantity of halide of Na and T1 in addition to Hg. According to the invention, the ionizable filling also contains Ca and is free from rare–earth halides, and further, the discharge vessel contains an oxygen dispenser.



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Metal-halide lamp.

The invention relates to a metal-halide lamp comprising a discharge vessel with a ceramic wall, the discharge vessel enclosing a discharge space which contains an ionizable filling which filling contains a quantity of halide of Na and Tl in addition to Hg.

A lamp of the type defined in the opening paragraph is known from EP-A-0 215 524 (PHN 11.485). The lamp comprises tungsten electrodes. The known lamp, which combines a high specific luminous flux with excellent color properties (inter alia general color rendition index $R_a \geq 0$ and a color temperature T_c between 2600 and 4000K), is highly suitable as a light source for, for example, interior lighting. With this lamp the perception is used to advantage that a good color rendition is possible when Na-halide is used as a filling component of a lamp and, when the lamp is in operation, there is a strong widening and reversal of the Na emission in the Na-D lines. This requires a high cold spot temperature T_{kp} in the discharge vessel of at least 1170K (900°C0). When the Na-D lines are reversed and widened, they assume in the spectrum the form of an emission band having two maximums mutually $\Delta\lambda$ apart.

The requirement of a large value of T_{kp} entails that the discharge vessel is relatively small, excludes the use of quartz or quartz glass for the wall of the discharge vessel and forces one to use ceramic for the wall of the discharge vessel.

In this description and these claims the ceramic wall is understood to mean both a wall of metal oxide such as, for example, sapphire or sintered polycrystalline Al_2O_3, and metal nitride, for example, AlN.

The filling of the discharge vessel contains besides Na and Tl, one or more rare-earth metals with which a desired value for the general color rendition index $R_a \geq 80$ and the color temperature T_c is realized. Rare-earth metals in this description and these claims are understood to mean the elements Sc, Y and the lanthanides.

A disadvantage of the known lamp is that under the influence of the rare-earth metals present during lamp operation there is corrosion of parts of the discharge vessel, more particularly, the wall. This finally results in a premature end of the lamp life. A further disadvantage of the known lamp is that also due to the relatively small dimensions of the discharge vessel, a

relatively fast blackening of the wall of the discharge vessel occurs owing to deposition on the wall of W evaporated from the electrodes.

It is an object of the invention to provide a measure for combatting the disadvantages described. A lamp according to the invention and of the type defined in the opening paragraph is therefore characterized in that the ionizable filling also contains Ca and is free from rare-earth halides.

The lamp according to the invention is advantageous in that, as a result of a surprisingly large spectral contribution of Ca both to the red and the blue, a value of $R_a \geq 80$ is realized for the general color rendition index and T_c up to 3500K is realized for the color temperature. In addition, it surprisingly appears that formation of stable Ca aluminate compounds is eliminated and the Ca present causes a W-halide cycle to develop as a result of which also the blackening of the wall of the discharge vessel owing to the evaporation of W of the electrodes is strongly counteracted. A condition for the occurrence of the W-halide cycle is the presence in the discharge vessel of a small quantity of free oxygen. Generally, the quantity of free oxygen comes from contaminations occurring during the manufacture of the lamp and released therefrom when the lamp is in the operating state. It has also been established that oxygen is released from the ceramic wall material under the influence of reactions with filling components of the discharge vessel. In the case of too small a concentration, it will hardly be possible to maintain the W-halide cycle sufficiently during the operation of the lamp. In the case of too large a concentration there will be, inter alia, corrosion of the W-electrodes.

In a preferred embodiment of the lamp according to the invention, the discharge vessel contains an oxygen dispenser. This has the important advantage that oxygen is introduced into the discharge vessel in a controlled manner. Bearing in mind an accuracy of manufacture required for a proper operation of the lamp and consequent scaling down of contaminations, there is a large chance of too small a concentration with respect to the quantity of O_2 that is released from contaminations. An additional advantage of the lamp according to the preferred embodiment is that dosaging during the life of the lamp becomes possible. In an advantageous embodiment of the lamp according to the invention, the oxygen dispenser contains CaO. CaO is advantageous in that by itself it forms part of the filling of the discharge vessel.

The filling of the discharge vessel can, in addition to Na and Tl, contain one or more metals, inter alia, for affecting the color properties of the lamp, for example, In. Besides the exclusion of rare-earth metals, a use of Ti, Zr and Hf is less suitable for the filling, because they form relatively stable oxides.

Experiments have shown that a value for $\Delta\lambda$ between 12nm and 60nm is desired for effecting good color properties of the lamp. With a value for T_{kp} in a range between 1200K and 1300K, a desired magnitude for $\Delta\lambda$ may generally be practicable, while also a maximum temperature of the wall of the discharge vessel up to 1450K can be realized.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

The drawing shows a metal-halide lamp with a cut-away view of a discharge vessel, not shown to scale, having a ceramic wall which encloses a discharge space 11 which discharge space contains an ionizable filling which in the case shown contains not only Hg, but also Na and Tl halide. The filling also contains an oxygen dispenser containing CaO, for example in the form of a ceramic CaO-impregnated carrier. Two electrodes 4, 5 having electrode rods 44, 54 and tops 45, 55 in a drawing each comprised of W, are arranged in the discharge vessel. The discharge vessel is closed on one side by a ceramic protruding plug 34, 35, which closely surrounds with clearance a lead-in 40, 41; 50, 51 respectively, to the electrode 4, 5 arranged in the discharge vessel, and is connected thereto in a gastight manner by means of a melting-ceramic joint 10 adjacent an end turned away from the discharge vessel. The construction of the discharge vessel is known per se, for example, from EP-0 587 238. The discharge vessel is surrounded by an outer bulb 1 on one end, having a lamp base 2. Between electrodes 4, 5 there is a discharge when the lamp is in operation. Electrode 4 is connected via a conductor 8 to a first electrical contact which forms part of the lamp base 2. Electrode 5 is connected via a conductor 9 to a second electrical contact which forms part of the lamp base 2.

In a practical embodiment of a lamp according to the invention as described in the drawing, the nominal power of the lamp is 70W and the lamp has a nominal lamp voltage of 90V. The translucent wall of the discharge vessel has a thickness of 0.8mm. The inner diameter of the discharge vessel is 6.85mm, the distance between the electrode tops is 7mm. The ionizable filling of the lamp contains in addition to 4.6mg Hg, 7mg (Na+Tl+Ca) jodide having a weight percentage composition of 28.8; 10.7 and 60.5. The discharge vessel also contains Ar as a start enhancer with a filling pressure of 300mbar. During the operation of the lamp, T_{kp} is 1265K. The lamp emits light with a specific luminous flux of 90lm/W for 100

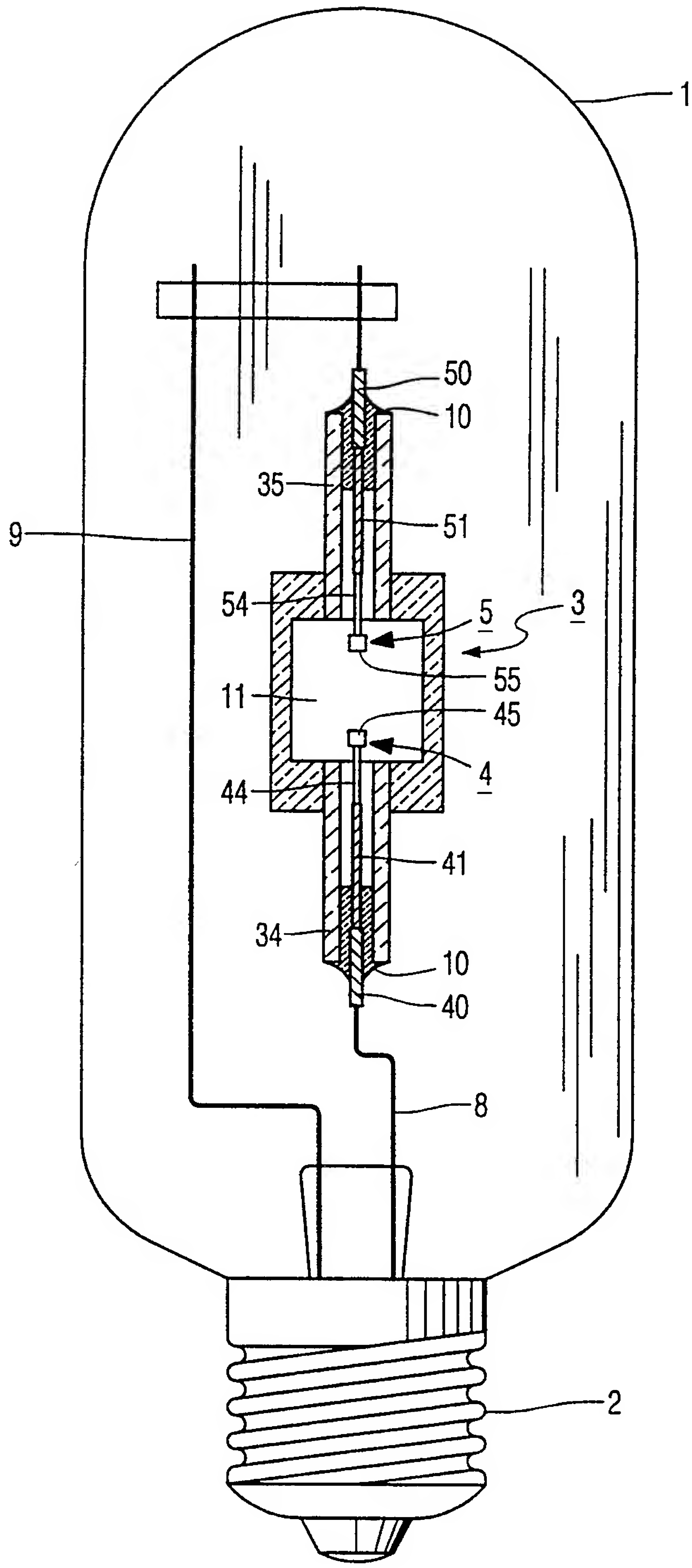
hours. The color temperature T_c of the emitted light is 3150K. The general color rendition index R_a is 84. After 10,000 burning hours the specific light stream is 88% of the value for 100 hours.

CLAIMS:

1. A metal-halide lamp comprising a discharge vessel (3) with a ceramic wall, the discharge vessel enclosing a discharge space (11) which contains an ionizable filling which filling contains a quantity of halide of Na and Tl in addition to Hg, characterized in that the ionizable filling also contains Ca and is free from rare-earth halides.

2. A lamp as claimed in claim 1, characterized in that the discharge vessel contains an oxygen dispenser.

3. A lamp as claimed in claim 1, characterized in that the oxygen dispenser contains CaO.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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 99/00536

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H01J 61/28 // H01J 61/26
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H01J, H01K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4918352 A (HESS ET AL), 17 April 1990 (17.04.90), column 3, line 52 - line 65, claims 1, 2	1-3
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D,A	EP 0587238 A1 (PHILIPS ELECTRONICS N.V.), 16 March 1994 (16.03.94), column 10, line 12 - line 20	1-3
	--	
A	US 4620129 A (LUTHRA), 28 October 1986 (28.10.86), claims 1-6, abstract	1-3
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P,A	WO 9822974 A1 (PHILIPS ELECTRONICS N.V.), 28 May 1998 (28.05.98), whole document	1-3
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4918352 A	17/04/90	NONE	
EP 0587238 A1	16/03/94	JP 6196131 A	15/07/94
		US 5424609 A	13/06/95
US 4620129 A	28/10/86	BR 8601990 A	06/01/87
		DE 3686193 A	03/09/92
		EP 0200109 A,B	05/11/86
		JP 61281450 A	11/12/86
WO 9822974 A1	28/05/98	CN 1209905 A	03/03/99
		EP 0876679 A	11/11/98